Episode Analysis for Evaluating Response Operations and Identifying Training Needs

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ABSTRACT
In Emergency Management (EM) teams are faced with dynamic and complex situations, often involving multiple teams and organizations working together under stressful circumstances. One of the key issues observed in emergency responses is inadequate communication. The communicative difficulties stem from various areas such as political, personal or jurisdictional. In order to improve communication and coordination, we need to gain a profound understanding of what the communication problems are and, further, we need to provide meaningful inter-organizational training regimes targeting these issues. We suggest *episode analysis*, a qualitative research method, to better understand the communication taking place during an emergency response. Episode analysis provides a way to code and analyze data involving multiple teams and organizations as well as a way to study more informal communicative functions that would otherwise be difficult to capture. Moreover, we suggest that episode analyses can be used to identify training needs and be helpful in creating meaningful training scenarios.

Author Keywords
Episode Analysis, Emergency Management, Training, Simulations, Qualitative research method

ACM Classification Keywords
H.5.3 Group and Organization Interfaces: Evaluation/methodology.

INTRODUCTION
Coordination and communication between teams and organizations is a key component for successful Emergency Management (EM). The dynamic and unpredictable nature of emergency responses makes successful communication vital and at the same time all the more demanding. The overabundance of information may create misunderstandings as well as problems with determining priorities, utilization of equipment and personnel, sometimes resulting in delays in services or the duplication of efforts [3, 6]. Further, functions and roles may have to be improvised to handle impending tasks, creating ad hoc structures not easily identified [6, 11, 8]. To improve the communication and coordination skills of responding teams it is becoming increasingly evident that we need a wider perspective encompassing what *does happen* during the responses, rather than focusing on what *should happen*.

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However, due to the nature of EM, there are some great challenges in studying and evaluating the efficiency of emergency response operations. Difficulties arise from, for instance, wide geographical distribution and a large number of different actors. Often, multiple organizations and teams are communicating at once, several events are taking place simultaneously, and new situations are constantly being created.

In this paper we suggest *episode analysis* for analyzing coordination and collaboration within and across multiple emergency services involved in an emergency response operation. Episode analysis is a bottom-up, data-driven qualitative research method used to study communication where multiple participants are involved [5]. The method provides the means to handle large amounts of data involving multiple teams and organizations as well as consider more informal issues influencing the task at hand.

The method has previously been applied to studies of joint emergency response operations [1, 8, 12]. These studies have shown that episode analysis has great potential for gaining in-depth insight into processes and functions, formal and informal, which go on during the emergency response operation. We suggest that episode analysis could be used to give scholars and practitioners better insight into what actually goes on and help create ecologically valid and meaningful training scenarios.

Communication is key to coordination of response operations
The definition of *coordination* has significantly varied in studies and literature. From simple interactions between organizations participating in an event to a more involved process of deliberately adjusting to each other and relaying information so that individual efforts can be intermeshed

with those of others (for a review see Drabek & McEntire [3]). Due to the loose definition it may be difficult to separate from communication [2]. However, it appears evident that one of the most important elements of coordination is communication.

In his comprehensive review of emergency response literature, Auf der Heide [2] showed that one of the most consistent observations about crises is inadequate communication. Reasons for this may be that boundaries not normally affected in daily emergencies are crossed, for example, taking on unfamiliar tasks, braking jurisdictional boundaries or rapidly restructuring the responding organizations. A few of the factors identified as promoting trust and therefore fostering good communication were: informal and personal contacts, joint training and organizational planning, preplanned agreements between the various emergency services and adaptation of similar terminology.

Emergent phenomena not captured by traditional methods

When studying an EM organization, documentation of communication during response operations is a key factor for understanding the human experience. However, capturing the processes, adaptations and underlying demands impose a great challenge; unexpected and rapidly unfolding events, geographical distribution, coordination of multiple teams and organizations are just some of the difficulties faced.

One very important issue discussed in coordination research is *emergent phenomena*, which arise when organizational personnel structure themselves to resolve the task demands placed on them. This type of emergent self-organization has been shown to enable a quicker and more effective emergency response [3, 6]. The ability to improvise organizational structures and roles is a key to successful response operations [3, 6, 7, 8, 9, 11, 12, 13].

The caveat is that many of these phenomena are not identified or captured by traditional top-down methods using predefined categories formed by the various missions the teams are performing [10]. A better ways of structuring large amounts of complex data is therefore necessary in order to give EM organizations the right training and tools to support their work in real events.

EPISODE ANALYSIS

In episode analysis episodes emerge from the data and not from predetermined missions of the task at hand. This open-ended analysis gives the opportunity to explore not only how the mission tasks are handled, but also issues not directly associated to the task at hand, such as emergent phenomena and improvisation.

In the analysis communication is broken down into subunits, called "episodes" [5]. Each unit contains an unbroken chain of actions internally bound together by a topical trajectory and/or a common activity [4]. An example, taken from a simulated EM response operation, is the episode "air quality" (a more detailed review is given in the next section). Within the episode all information, i.e. recorded interactions, observations and notes, concerning the issue of handling the air quality during the forest fire is bound together in an episode [8].

It is not sufficient to analyze communication without acknowledging surrounding information about the situation and unfolding events. The episode analysis uses a context dependent approach and episodes are created based on what initiates the situation. The initiations can be grounded in a *situation*, *cotext*[1] or *knowledge* [4]. If an episode or subunit is grounded in a situation, this means that an occurrence has triggered an event in real time. This could for example be a new fire, a phone call or something else in the context that triggers the event. A subunit grounded in cotext signifies that a previous event within the interaction has triggered the current event, for example a previous topic is once again brought forward etc. Knowledge based events are triggered by previous knowledge and experiences, for example a request for ambulance assistance as a result of previous experience from similar emergency response operations [12]. Other constraints such as physical, organizational, and cultural aspects influencing the performance of the participants also need to be taken into consideration by the researcher.

An example of using episode analysis

In this section an example of an episode analysis in EM is given [8]. The analysis was performed on data collected from a simulation that was a real-time role-playing exercise for command staff in the Swedish Response Team (SRT)[2]. The scenario was based on a real event; the 2007 California wildfires. The main task for the SRT was to offer support to Swedish citizens in the area and prepare for potential evacuation. The main focus of the analysis was to better understand the participants' adaptive and improvised behavior. For this an episode was chosen where two commanders had to take on a task they were not trained for - the previously mentioned "air quality" episode. The task involved for example increasing awareness about hazardous smoke and providing information on what protective face-masks may be suitable. All interactions, observations and notes concerning this task were compiled and formed the air quality episode.

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[1] *Cotext* is the *textual context* of a text. This means that an initiating trigger comes from something going on in the conversation. This could for example be a previously discussed idea re-surfacing and being applied to the current circumstances.

[2] The SRT is a rapid response taskforce that can be deployed to assist and support the Ministry of Foreign Affairs through the Swedish embassies. Their primary task is to assist Swedish citizens affected during serious emergencies abroad.

The episode was, in this particular example, broken down into smaller units, so called "sub-episodes" (SE) (see figure 1). This was done in order to better understand what triggered each event that affected the progress of this specific episode. This was done by using the categories mentioned above; situation, cotext or knowledge. Figure 1 shows the eleven sub-episodes on a spatial-temporal scale. The horizontal line indicates the temporal scale. The simulation went on for approximately four hours. Overlapping sub-episodes show the spatial scale; if they are overlapping this means that the two episodes are present in the same interaction. For instance, SE2 (sub-episode 2) involves two staff members searching through newspaper-articles and reports to gather information about the hazardous smoke. A phone-call about the smoke is made to one of the two staff members; this is the event that triggers SE3, but both SE are present in the same interaction and therefore overlap in the figure. The coloring is of no significance other than making it easier to distinguish one SE from another.

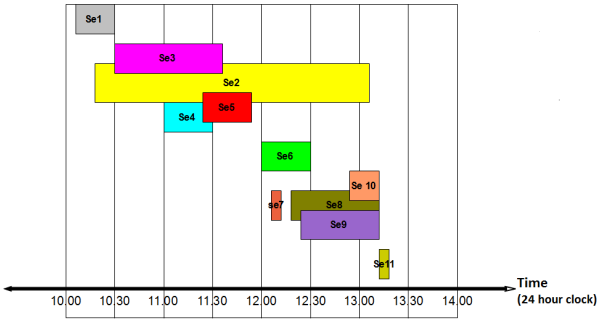

Figure 1. The episode "air quality" broken down into sub-episodes (Rankin, 2009).

Three examples of what the episodes contain as well as what triggered them are given below. SE1 is a joint briefing initiated by the staff commander taking over the command post previously established by the assessment team (played by simulation staff). This episode falls under the category *situation* as the initiating factor is something happening in real-time, i.e. the staff members have arrived and are briefed on the current situation. SE6 is initiated by one of the staff members sending an e-mail to the Swedish Civil Contingencies Agency asking for expert advice on face-mask filters. This episode falls under the category of *cotext* as the issue of different filters had been discussed in previous interactions. Contacting the authorities for more information was, however, initiated at this point. SE10 was initiated by two members of the staff introducing a rotating schedule for staff members. The reason for this would be to avoid any one person being exposed to hazardous smoke for a long period of time. The SE was categorized *knowledge* as it was initiated by previous knowledge and experience of the two staff members.

Identifying triggers of events gave the opportunity to map out the teams' reactive and proactive work [8]. This showed a trend of how the response team became more proactive further into the simulation. Initially they acted on reactive bases (*situation*) but then subsequently started to be more proactive; reiterating previous issues (*cotext*) as well as using their expert knowledge (*knowledge*) to manage the task. The analysis also provided a map of how information was mediated throughout the teams and organizations, which helped to pin-point when and why misunderstandings took place. The analysis exposed failures in the teams' ability to improvise roles which were not detected by the participants or the expert observers on site during the simulation. Further, the detailed analysis of communication showed where shortages occurred, uncovering how information got distorted as it travelled through the organization.

Creating scenarios for training environments

We suggest that episode analysis can be used as a tool for identifying the training needs of organizations. Previous studies show that the method can give valuable insight into ongoing processes and identify issues that are perhaps not evident on site. Informal communication and improvised roles are some of these. We do not want to eliminate these aspects of teamwork as they play a critical role for successful response operations. Rather, we want to maintain resilient organizations and make sure that the personnel are trained to be flexible and able to adapt to the prevailing situation.

An analysis to identify training needs can be performed on either real-life events or previous training exercises. Using simulated environments is, of course, of great advantage for the researcher as it makes it easier to document all communication and to control the initial scenario. On the other hand, studying EM in real life settings can be challenging but is necessary for increased validity. An example of how episode analysis can provide support for scenario creation is given below. The example is taken from the episode analysis performed on the Swedish Response Team SRT [8].

Several of the team members in the SRT had to take on roles they were not specifically trained for; they had to, to some extent, improvise. The analysis showed that this caused some rather serious problems due to information being misinterpreted. The analysis identified three main causes for the misunderstandings [8];

(1) Insufficient domain knowledge

(2) Language/communication difficulties

(3) Poor organizational structure

The first reason, insufficient domain knowledge, is not surprising considering that the staff members were acting outside their own field of competence in their improvised roles. The second reason appears to stem from the constant switch between English and Swedish; within the team the

staff members spoke Swedish, but when communicating with outsiders they spoke English. The third reason for the misunderstandings was that responsibilities where unclear and for that reason proper hand-overs were not executed. These main reasons led to information getting lost and/or distorted. Interestingly, it appears as if the presence of all these factors where necessary for the mistakes to take place, several small issues here and there led to few major misunderstandings. The conclusion is that when some parts of the system is weaker - in this case it was the missing expert knowledge - other parts, such as the organizational structure, in terms of proper hand-overs and clear responsibilities need to be stronger[3] [8].

From this analysis it is evident that response teams need more training on how to keep the organizational structures strong *and* flexible. Creating scenarios where certain functions are missing will give participants the opportunity to act in different roles and identify risks that may occur when the team is stressed in various ways. The analysis shows that the persons acting outside their field of competence neither requested nor received increased support from the organization. This lead to a weakened team and that tasks were subsequently abandoned. Training for these types of situations will provide increased awareness for the teams and draw their attention to the pitfalls of improvising.

DISCUSSION

Episode analysis has, in previous studies, proven to be a useful method for breaking down large amounts of data where multiple persons and organizations are involved [1, 8, 12]. It provides a natural way of categorizing several events and tasks occurring simultaneously. The bottom-up approach also allows room for informal issues to surface and deepens the understanding of functions and events taking place that may not be possible to identify using a top-down approach. For example, mistakes and misunderstanding taking place when participants had improvised roles were not detected by the on-site observers, but surfaced in the subsequent episode analysis [8].

The importance of understanding these informal functions was made clear in the study by Trnka & Johansson [12]. In their study of fire fighters they concluded that the response would not have been successful had the commanders stuck strictly to their formal organization and predefined roles. Furthermore, it was made clear that the organization's technological structure did not support the informal structure created during the response.

The method also has the potential of identifying training needs. Having access to a detailed description of mistakes and their true source can be of great assistance when creating new training scenarios that will make response teams aware of the communicative difficulties that so often exist in inter-organizational response operations.

Naturally, there are some drawbacks with this method. One of these is that episode analysis is time consuming. Although this would likely be the case in most studies facing a large amount of data, using a bottom-up approach is generally more time consuming than a top-down approach. Furthermore, to gain the greatest benefit the method requires sufficient amounts of data to be able to recreate and understand the events, context and communication that have taken place.

CONCLUSION

We believe that episode analysis can be of great assistance in further understanding coordination and communication in EM. It has so far proven to give new, in-depth, perspective on, for instance, informal or improvised roles. It is of great importance for EM that these aspects of teamwork are understood and can be supported by the organization and the technology used. So far, the method has only been applied to data collected in simulated environments. We do suggest, however, that future research should explore the method by applying it to data collected in real events to increase ecological validity. Further, we suggest that this type of analysis can be used to identify weaknesses in the teams and organizations, giving insight into their training needs as well as the type of scenarios that should be used for training.

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